Mass transit options: recent developments in Asia

Karl Fjellstrom, GTZ SUTP-Asia
7 October 2003, Envirotech 2003, Jakarta Convention Centre

What are the options?

- Bus rapid transit
- Light Rail Transit
- Underground metro
- Urban rail

What is Bus Rapid Transit?

Bus Rapid Transit is high-quality, customer-oriented transit that delivers fast, comfortable and low-cost urban mobility.

- Characteristics
  - Segregated busways
  - Rapid boarding and alighting
  - Effective regulation and planning
  - Efficient fare collection
  - Comfortable shelters and stations
  - Clean bus technologies
  - Modal integration
  - Sophisticated marketing identity
  - Excellence in customer service

Lloyd Wright, ITDP 2002
BRT resources

- www.gobrt.org
- www.busrapidtransit.net
- www.brtchina.org
- www.sutp.org
- www.itdp.org
- www.nbrti.org
- www.transmilenio.gov.co

The economics of BRT

<table>
<thead>
<tr>
<th>BRT</th>
<th>Metros and rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1-10 million / km</td>
<td>$20-220 million / km</td>
</tr>
</tbody>
</table>

Two systems: same cost

Rail system

- Rail
- Metro

Bus Rapid Transit system

- Bus
- Rapid
- Transit

‘Dead rail transit’? Campinas, Brazil

Sao Paulo metro:
Heavy and ongoing financial implications for the city, even with high ridership

Photograph of Campinas Central Station, published in Correio Popular, a Campinas newspaper, on 16 August 1997.
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**Station cost comparison**

- BRT Station: Quito, Ecuador - $35,000
- Rail Station: Porto Alegre, Brazil - $150 million

**Planning and construction time**

- BRT: 12 - 18 months
- Metros: 3 – 30 years

**Flexibility of BRT**

- Growing and changing with the city

**Passenger capacity and speed**

- Source: Dario Hidalgo, Deputy Director of TransMilenio S.A., Unpublished paper, May 2003
Institutions, environment, and poverty alleviation

- BRT is less institutionally demanding
- Environmental impacts: mode split is the key
- Poverty alleviation: mobility for the urban poor

Metros & LRTs: East & South Asia

In operation:
- Bangkok
- Fukuoka
- Kobe
- Naha
- Singapore
- Beijing
- Guangzhou
- Kyoto
- Osaka
- Taipei
- Busan
- Haifa
- Kuala Lumpur
- Pyongyang
- Tianjin
- Calcutta
- Hiroshima
- Manila
- Sapporo
- Tokyo
- Chennai
- Hong Kong
- Mumbai
- Seoul
- Daegu
- Incheon
- Nagoya
- Shanghai
- Sendai
- Delhi
- Kitakyushu

Under construction:
- Bangkok
- Daegu
- Kawasaki
- Naha
- Tokyo
- Beijing
- Daejeon
- Kuala Lumpur
- Shanghai
- Shenyang
- Chengdu
- Guangzhou
- Nagoya
- Shenzhen
- Chiba
- Gwangju
- Nanjing
- Taipei
- Chongqing
- Kachiuang
- Osaka
- Tianjin

BRT in South & East Asia

In operation:
- Akita
- Kanazawa
- Nagoya
- Ankara
- Kunming
- Nigata
- Fukuoka
- Miyazaki
- Taipei
- Gifu
- Nagaoka

In planning or under construction:
- Bangalore
- Delhi
- Manila
- Beijing
- Jakarta
- Seoul
- Chengdu
- Kuning
- Taipei
- Shijiazhuang
- Shenyang

Mode shifting potential of BRT

<table>
<thead>
<tr>
<th>City</th>
<th>Earlier year % of motorised trips</th>
<th>Later year % of motorised trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico City</td>
<td>2000 80</td>
<td>1994 72</td>
</tr>
<tr>
<td>Buenos Aires</td>
<td>1993 49</td>
<td>1999 33</td>
</tr>
<tr>
<td>Bangkok</td>
<td>1970 53</td>
<td>1990 38</td>
</tr>
<tr>
<td>Shanghai</td>
<td>1986 24</td>
<td>1995 15</td>
</tr>
<tr>
<td>Warsaw</td>
<td>1987 80</td>
<td>1998 53</td>
</tr>
<tr>
<td>Sao Paulo</td>
<td>1977 46</td>
<td>1997 33</td>
</tr>
<tr>
<td>Tokyo</td>
<td>1970 65</td>
<td>1990 48</td>
</tr>
<tr>
<td>Seoul</td>
<td>1970 81</td>
<td>1990 63</td>
</tr>
<tr>
<td>Kuala Lumpur</td>
<td>1985 34</td>
<td>1997 19</td>
</tr>
<tr>
<td>Santiago</td>
<td>1977 20</td>
<td>1991 66</td>
</tr>
</tbody>
</table>


Curitiba: 23.6% increase in ridership per year for 20 yrs, maintaining transit mode share

Bogota: increase in transit mode share from 67 to 68% after only 2 out of 22 BRT lines open
Some case study cities

1. Bangkok
2. Kuala Lumpur
3. Singapore
4. Delhi
5. Chengdu
6. Beijing
7. Kunming
8. Taipei
9. Seoul

Case study #1: Bangkok

- Bangkok’s bus sector: the need for reform
- The Skytrain, ferries, suburban rail & others
- The Blue Line (subway)
  - 20km, 18 stations, operating August 2004
  - ~US$145 million per kilometre (public funds)
- The role of massive construction companies
- Amenability of Bangkok to BRT
  - High existing demand
  - Severe congestion
  - Ample road space
- Prospects for Bangkok?

Case study #2: Kuala Lumpur

- PUTRA & STAR
- KLIA & the commuter lines
- The KL Monorail (8.6km, 11 stations, 7 years)
  - $79m support loan from govt
  - $163m loan from a bank owned by the Ministry of Entrepreneur Devt
  - $68m equity from shareholders
- Impacts: megaproject financial failures, failing to meet mobility needs. Mode split for public transport languishes at around 15% (from 34% in 1985)

Star & Putra LRT

- Putra had debts of more than US$1.4 bn after 3 yrs of operation, Star $315 m
- Assets transferred in Sept 2002 to a fully-owned subsidiary of the Ministry of Finance
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Case study #3: Singapore’s NEL

- US$1.45m per km, 20km, fully underground
- Nearly 8 years under construction
- Forecast 250,000 pax per day, actual 150,000
- Public outcry over withdrawal of 9 bus lines (to remove competition with NEL), and failure to open Buangkok station

SBS Transit: Since the NEL opened, shares have fallen 12%. Over the same period, the overall index rose by 27%.

Case study #4: Delhi

- Currently 12 million vehicular trips are made each day in Delhi.
- 7.5 million trips, or 62.5%, are by bus.
- 6% are by bicycle
- **Delhi metro**: plan for 62 km, 12.8km currently operating. Plan for 240 km by 2021
- US$37.5m per km (official projection)
- **Delhi HCBS**: 6.4 km initial segment, as part of 18km first corridor, construction likely to commence early 2004. (Cost of US$16 million)
- Open system, not competing with metro, probably not a metro ‘antidote’

Case study #5: Chengdu BRT plans

Source: Chengdu Urban Planning and Design Institute, 2003
Case study #6: Beijing

- Beijing Transport Committee commitment to BRT corridors (Sept. 03)
- Draft feasibility study submitted to govt. Oct. 03. If approved, design to be completed and construction can commence in 2004
- 14.5km initial route, south from Qianman
- Construction already effectively commenced
- Closed system, dedicated vehicles, central platform stations

Case study #7: Kunming

- Positioned in the middle lane
- Commenced Apr. 99. By Sept. 2003, 20km operating, planned 41km
- Platform at intersection
- Cost and project duration
  - 1st bus lane: 7 million RMB, 2 months
  - 2nd bus lane: 21 million RMB, 6 months
  - Cost per km: 1.4-2.1 million RMB
- Passenger Volume
  - 1999: 500,000/day; 2002: 900,000/day
  - Bus trip percentage: from 6% to 12%

<table>
<thead>
<tr>
<th></th>
<th>Before opening the bus lane</th>
<th>After opening the bus lane</th>
<th>Increase and reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car traffic flow</td>
<td>1840 per hour</td>
<td>1326 per hour</td>
<td>-12.4%</td>
</tr>
<tr>
<td>Standard car traffic flow</td>
<td>2150 per hour</td>
<td>1740 per hour</td>
<td>-5%</td>
</tr>
<tr>
<td>Passenger volume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non publ. transp. vehicles</td>
<td>4233 people per hour</td>
<td>3051 people per hour</td>
<td>-7.4%</td>
</tr>
<tr>
<td>Bus</td>
<td>9,936 people per hour</td>
<td>11,256 people per hour</td>
<td>+21%</td>
</tr>
<tr>
<td>Total*</td>
<td>14,169 people per hour</td>
<td>14,307 people per hour</td>
<td>+12.4%</td>
</tr>
<tr>
<td>Actual transport capacity of bus</td>
<td>11,040 people per hour</td>
<td>16,000 people per hour</td>
<td>+45%</td>
</tr>
<tr>
<td>Occupancy Rate of buses</td>
<td>About 90%</td>
<td>About 70%</td>
<td>-17%</td>
</tr>
<tr>
<td>Average speed of busses</td>
<td>9.6km/h</td>
<td>15.2km/h</td>
<td>+56.3%</td>
</tr>
<tr>
<td>Average boarding / descending time</td>
<td>56 seconds</td>
<td>23 seconds</td>
<td>-50%</td>
</tr>
</tbody>
</table>

Source: Kunming General Bus Company, 2002
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Case study #8: Taipei

Part of a package of measures to improve air quality and the urban environment

Total Length: 57 km (Mar-89~Dec-01)
No. of Bus Stops: 143 (400m spacing)
Avg. Construction Cost: US$500,000/km

Source: Dr. Jason Chang, 2002

Case study #9: Seoul

Seoul’s exclusive median buslane program

11 roads, 137.5km (completed by end of 2004)
First stage: 6 roads of 73.5km
Second stage: 5 roads of 64.0km

Some lessons learned

Comparing mass transit options:
- Cost
- Construction time
- Passenger capacity
- Financial burden
- Flexibility
- Institutional demands
- Environmental impacts
- Poverty reduction potential

Risks and financial burdens of government guarantees

- Utilised in many cities including Manila and Kuala Lumpur for metro projects
- May be too onerous for the government and effectively transfer the risk from the private sector back to the public sector.
- Consign the govt to redeeming ill-conceived projects?
- In creating an attractive environment for private participation in high capital cost ventures, the principles of private sector risk can be eroded.
- When costs rise unexpectedly and ridership levels are disappointing, the government, which was keen to involve private capital, can become liable for debt repayments.
- The private sector may realize returns on its investment but the government may be left with an expensive scheme that does not adequately meet the mobility needs of its citizens.
Selecting initial BRT routes

- Ideally based on an o/d analysis, but this seems to be rarely the case
- Most benefits where existing conditions are congested
- Serving demand: best where existing demand exceeds 5,000 passengers per hour per direction
- Adequate road space, min. 25m ROW

Other aspects of BRT planning

- The risks of pilots and demonstrations
- Getting political buy-in (bus sector reform experience in Bangkok, Jakarta, Surabaya, Denpasar, Bandung, …)
- Modal integration: the critical role of non-motorised transportation
- Station location
- Open or closed system
- ‘World class’ or ‘budget’ BRT
- Possible roles of the private sector

Comprehensive BRT planning

- Core team formation
- Pre-planning analysis
- BRT system structure
- Communications, customer service and marketing
- Engineering and design
- Technology and equipment
- Modal integration
- Plans for implementation
- A city vision